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Importance of Ankle/Brachial Pressure Index in Saudi Patients with Coronary Artery Disease

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ABSTRACT

Background: The ankle/brachial pressure index (ABPI) has been shown to be a good marker of systemic atherosclerosis and a powerful predictor of cardiovascular morbidity and mortality. The objective of this study was to determine the importance of measuring ABPI in Saudi patients with coronary artery disease (CAD). METHODS: This is a hospital based cross-sectional study which was conducted on all Saudi patients who underwent coronary angiography without symptoms of peripheral arterial disease at King Fahd Hospital of the University, Al-Khobar Saudi Arabia. All patients underwent measurement of their ABPI. The study was carried out between December 2010 and November 2011. RESULTS: During the study period, two hundred and five patients were included. Fifty-nine (28.8%) patients were Group II (ABPI ≤ 0.90) and the rest was Group I (ABPI > 0.90). Significant correlation was also found between low ABPI and the extent of CAD (mean number of arteries involved in Group I was 1.78 ± 0.83 compared to 2.10 ± 0.736 in Group II $p = 0.011$). Nevertheless, the correlation between low ABPI, and the severity of presentation of CAD were also significant (Incidence of myocardial infarction with congestive heart failure was 0.5% in Group I compared to 12% in Group II $p < 0.001$). CONCLUSION: The ABPI is an important prognostic indicator for Saudi patients with CAD.

Keywords: Coronary Artery Disease; Ankle Brachial Pressure Index; Atherosclerosis

1. Introduction

Atherosclerotic diseases are the leading causes of death throughout the world and are estimated to account for 24% of all mortality worldwide in the year 2000 [1,2]. Atherosclerosis is a systemic disease and can affect different territories at the same time [3-6]. There was more than one arterial territory affected at the same time in 12% [1] - 40% [7]. Several epidemiological studies have shown positive association between coronary artery disease (CAD) and peripheral arterial disease (PAD) [4,8,9]. The ankle/brachial pressure index (ABPI), used to diagnose PAD, has been shown to be a good marker of systemic atherosclerosis and a powerful predictor of cardiovascular morbidity and mortality [10]. The objective of this study was to determine the importance of measuring ABPI in Saudi patients with CAD.

2. Patients and Methods

This is a hospital based cross-sectional study on consecutive series of patients underwent coronary angiography without symptoms of PAD at King Fahd Hospital of the University, Al-Khobar Saudi Arabia. "ABPI" has been measured for all patients. The study was carried out between December 2010 and November 2011.

Risk factors for atherosclerosis were stratified for all patients including: diabetes mellitus, smoking, dyslipidemia, hypertension and obesity measured by body mass index (BMI). Information on age and gender was also recorded.

Hypertension was defined as mean systolic blood pressure of ≥140 mmHg, mean diastolic blood pressure of ≥90 mmHg, physician diagnosis, or medication use. Average blood pressure was composed of up to four readings on two separate occasions. Dyslipidemia was defined as triglyceride level ≥150 mg/dl and/or HDL level ≤40 mg/dl in males or ≤50 mg/dl in females and/or LDL-C level ≥160 mg/dl and/or physician diagnosis or medication use. Diabetes was defined as self-reported physician diagnosis, use of antihyperglycemic agents, fasting glucose of ≥126 mg/dl in 3 separate occasions, 2

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hours post 75 gm oral glucose tolerance test of ≥200 mg/dl in 3 separate occasions , random blood glucose ≥200 mg/dl in the presence of classical symptoms of hyperglycemia or hemoglobine A1C >6.5%.

2.1. Coronary Angiography

All patients underwent selective coronary angiography using the standard technique. Lesion severity assessed visually if more than 70% or less than 40% but for lesions between 40% - 70% Computer-Assisted Quantitative Angiography (QCA) used to calculate the severity of the lesion. Lesion considered being significant if the luminal stenosis exceeds 50% in any epicardial vessel. The extent of CAD was reported as one, two or three vessel disease and if there is left main artery involvement. The presentation of CAD was graded as: stable angina, Non ST elevation acute coronary syndrome (NSTEMI), ST-elevation acute coronary syndrome (STEMI) and/or congestive heart failure.

A comprehensive medical history was obtained from all patients, full physical examination was performed with special attention to palpating pulses in both lower extremities. Any patient had history of claudication, rest pain, ulcer, ischemic ulcer or gangrene was excluded from the study. Measuring of ABPI was obtained from each extremity using a Multi Doppler II Advanced Bi-directional Doppler (Huntleigh, UK). The higher measured values of the arm and ankle pressures (dorsalis pedis or posterior tibial) were used to calculate ABPI. Patients were considered to have PAD if the ABPI was <0.9. The blood pressure was measured by one trained nurse and the ABPI by consultant or senior registrar in vascular surgery.

Patients were divided into 2 groups based on the ABPI results. Those with ABI ≥0.9 were assigned as Group I and those <0.9 as Group II.

2.2. Statistical Analysis

Comparison between prevalence of risk factors in both Groups I & II was done. Data of the 2 groups were summarized either as the mean ± standard deviation (SD) or as percentage of the risk factors. Differences between the groups were tested for statistical significance using t-test, chi-square test or Fisher's exact test as appropriate. Significance was set at $p < 0.05$ and 0.05 - 0.1 was considered as statistical trend for all comparisons. Statistical analyses were performed using SPSS 15 software (Chicago, USA).

3. Results

During the study period, two hundred and five patients were included. The mean age (±SD) was 54.7 ± 9.73 years (range 29 - 81) with high incidence of dyslipidemia (86%) **Table 1**. One hundred forty six (71.2%) of our patients were classified as group I and Fifty nine (28.8%) patients as Group II. Group II was significantly older than Group I (53.27 ± 9.06 in Group I compared to 58.25 ± 10.52 in Group II $p = 0.001$). There was also signify-cant difference between both groups in the incidence of diabetes mellitus (74 (51%) in Group I compared to 42 (71%) in Group II $p = 0.012$) and hypertension (72 (49%) in Group I compared to 44 (75%) in Group II $p = 0.001$). There were no significant differences between both groups as regards gender distribution, dyslipidemia, smoking, family history and BMI (**Table 2**).

Significant correlation was also found between low ABPI and the extent of CAD (mean number of arteries involved in Group I was 1.78 ± 0.83 compared to 2.10 ± 0.736 in Group II $p = 0.011$ **Table 3**). Nevertheless, the correlation between low ABPI, and the severity of presentation of CAD was also significant (Incidence of Myocardial infarction with congestive heart failure was 0.5% in group I compared to 12% in Group II $p < 0.001$) (**Table 4**).

Discussion

Peripheral arterial disease is a common manifestation of atherosclerosis [11]. It is associated with increased risk for cardiovascular events due to coexistence of CAD and cerebrovascular disease, such events being more frequent

Table 1. Patients characteristic.

Characteristic	No
Age (mean ± SD)	54.7 ± 9.73
Sex: Male/Female	167/38
Diabetes	116 (56%)
Smoking	87 (42%)
Hypertension	116 (56%)
Dyslipidemia	176 (86%)
Family history of cardiovascular disease	20 (10%)
BMI (mean ± SD)	28.6 ± 5.11

Table 2. Risk factors for atherosclerosis.

	Group I (No. 146)	Group II (No. 59)	p value
Age (mean ± SD)	53.27 ± 9.06	58.25 ± 10.52	0.001
Sex (male/female)	123/23	44/15	0.11
Diabetes mellitus	74 (51%)	42 (71%)	0.012
Hypertension	72 (49%)	44 (75%)	0.001
Dyslipidemia	126 (86%)	50 (85%)	0.77
Smoking	62 (43%)	25 (42%)	0.99
Family history	16 (11%)	4 (7%)	0.36
BMI (mean ± SD)	29.3 ± 5.6	28.4 ± 4.9	0.26

Table 3. Extent of coronary artery disease.

	Group I (No. 146)	Group II (No. 59)	p value
Number of single vessel (%)	70 (48%)	11 (19%)	<0.0001
Number of two vessels (%)	38 (26%)	26 (44%)	0.013
Number of three vessels (%)	38 (26%)	22 (37%)	0.090
Number of vessels (mean ± SD)	1.78 ± 0.83	2.10 ± 0.736	0.011
LM involvement (%)	6 (4%)	4 (7%)	0.474

Table 4. Presentation of coronary artery disease.

	Group I (No. 146)	Group II (No. 59)	p value
Stable angina	39 (27.5%)	20 (34%)	0.30
NSTEMI acute coronary syndrome	55 (38%)	18 (30%)	0.33
STEMI acute coronary syndrome	51 (35%)	14 (24%)	0.11
Myocardial infarction with congestive heart failure	1 (0.5%)	7 (12%)	<0.001

than ischaemic limb events [12,13]. There is a 20% - 60% increased risk for myocardial infarction (MI), a two to six-fold increased risk of cardiovascular death, and a 40% increased risk of stroke in patients with PAD [14]. These adverse consequences of PAD occur, in part, because many affected patients are not diagnosed, and those with known PAD often are undertreated. With the use of the ABPI, studies have shown that there is a significant increase in diagnosis of patients with PAD who have coexistent CAD [15-18]. The present study revealed that about 29% of our patients to have asymptomatic PAD.

The conventional risk factors for PAD and CAD including diabetes, hypertension, smoking and dyslipidemia were very common in our patients (56%, 56%, 42% and 86% respectively) and this was concordant with data seen in previous studies [19-21]. The present study like others [22] has shown that different cardiovascular risk factors have variable influence on atherosclerosis in different territories. Diabetes was more frequent in PAD [7,22-27].

In population-based studies such as the Framingham Heart Study and Edinburgh Artery Study, the relative risk of developing PAD increases by 1.5 to 4 times in patients with diabetes [19-28]. These data is supporting remarkable impact of diabetes on the progression of the atherosclerotic process. Smoking was less evident in PAD in the present study. However, it was more apparent in other studies [7,22-27]. Whereas, the impact of dyslipidemia was less marked in PAD (present study and others [7,23,24,29]). In agreement with our results hypertension was more common in PAD [7,24]. There was agreement between current and previous study [30] that estimated that approximately 25% of patients over the age of 55 in a general medical practice have PAD.

Our Study demonstrated that among patients with documented CAD; 28% have asymptomatic PAD which is higher than that have been shown in other western studies (21% - 22%) [24,31]. This might indicate the higher prevalence of asymptomatic PAD in Saudi patients compared to other ethnic groups. In agreement with the Peripheral Arterial Disease in Interventional Patients Study (PIPS) [32] a significant correlation was found between low APBI and the extent of CAD (mean number of arteries involved). Furthermore, involvement of left main coronary was shown to be significantly higher in patients with PAD (present study and others [33]).

The presence of asymptomatic PAD confers on average a 30% risk of myocardial infarction, stroke, and vascular death over 5 years [34]. In our study, Patients with CAD and low ABPI had more incidence of myocardial infarction with congestive heart failure compared to those with ABPI >1 (12% 0.5% $p < 0.001$). This finding is very important since presence of PAD might be used in the risk stratification to indicate higher risk CAD patients who will need more aggressive intervention including percutaneous revascularization and coronary artery bypass surgery. In addition, early detection of PAD is fundamental to implement early risk Factor modification and disease management.

4. Conclusion

Our prospective study showed that PAD is highly prevalent among patients with angiographically documented CAD. Use of ABPI is a very valuable and easy diagnostic method to screen such patients for concomitant PAD. Low ABPI is associated with more diffuse CAD and linked to worse clinical outcome with higher incidence of myocardial infarction and congestive heart failure.

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